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ANÆSTHESIA IN PSYCHOSURGERY

BY

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THE treatment of psychotic and psychoneurotic patients by surgical interruption of the frontal association pathways is known as prefrontal leucotomy or lobotomy. The operation was introduced in 1935 by Egas Moniz of Portugal, who first used absolute alcohol to ablate the tissue. Later he devised the leucotome for mechanical division of the nervous fibres. The favourable results obtained by the operation, especially in cases of chronic depression, and those showing behaviour disturbances, are leading psychiatrists to enlist the help of the surgeon with growing frequency. How and why these results are obtained is being debated and investigated.

The operation, which is bilateral, consists of incising the scalp, making a trephine hole through the skull at a point 3 cm. behind the outer margin of the orbit, and 6 cm. above the zygoma. After incising the dura the leucotome is introduced into the brain substance and the white matter of the frontal lobe is divided. Suture of the scalp concludes the operation.

CHOICE OF ANÆSTHETIC

Some of the patients are lacking in co-operation, while in a few this phrase may be regarded as an understatement. As a consequence, local analgesia is often contra-indicated. An

operation performed under local analgesia, especially when it is on a brain preoccupied by abnormal fears and anxieties, must be a trying experience for even the most stout-hearted patient. Add to this such details as strapping of the limbs to the table, the hiss of the sucker, the crackle of the diathermy and the burring of the drill, and it will be appreciated that general anæsthesia is usually the method of choice. American workers use local analgesia in the operation more frequently than we do. Freeman and Watts[1] needed general anæsthesia in only half of their cases and then favoured Avertin 80 mg. per kilo with nitrous oxide oxygen and ether if necessary. This was always combined with local infiltration. Petersen and Buchstein[2] recommend Nembutal gr. iii one and a half hours before, and morphine gr. $\frac{1}{4}$ and hyoscine 1/150 ten minutes before operation. They then proceed with local infiltration, but in a proportion of their cases pentothal sodium was necessary at some time during the proceedings. Fleming *et al*[3] used local in their first cases but found the experience terrifying for the patients and thereafter used general anæsthesia. Willway[4] and McKissock[5] both preferred general anæsthesia.

In selecting a general anæsthetic, an agent or combination of agents must be chosen which will not explode if the diathermy machine is used. As many of these operations are performed in the operating theatres of mental hospitals, some of which are not supplied with electro-surgical units, the explosion hazard may not arise and so ether may not be contra-indicated on this account. The method of administration must be well tolerated by the patient and in this connection Avertin may be only partially retained in refractory cases. Finally, oozing from the brain substance must be minimised.

Oozing is increased by the use of ether, which causes vaso-dilatation of the cerebral vessels and an increase in the cerebral blood content. A poor airway produces bad operating conditions in three ways. The anoxia accompanying it causes an increase in intracellular fluid; the accumulation of carbon dioxide causes a dilatation of the cerebral vessels[6] while the increased expiratory effort gives rise to increased intra-thoracic pressure and so increased venous pressure and consequent oozing. An intratracheal tube overcomes these difficulties, and, in addition, enables artificial respiration to be easily performed

by inflation of the lungs with oxygen should respiratory depression occur.

Chloroform used in minimal quantities to supplement gas and oxygen has the disadvantage that it may sensitize the conducting automatic tissue of the heart to the action of adrenalin used to render the scalp ischæmic. Ventricular fibrillation is thus a constant risk. We have used cobefrin-novocain to perform the scalp block, but it is not as efficient as adrenalin-novocain or adrenalin-saline in reducing bleeding. Moreover, its use with chloroform does not remove the danger of ventricular fibrillation.[7]

Gas oxygen with minimal trilene is a suitable anæsthetic, but occasionally tachypnœa is produced, various cardiac arrhythmias may occur and the post-operative vomiting rate has seemed to be higher than when pentothal is employed. Pentothal, gas and oxygen, used in all but 13 of this series of 75 cases has been the favourite method of general anæsthesia. Smith[9] has shown that intracranial pressure during general anæsthesia is lower than average when pentothal is used.

Technique

Premedication consists of hypodermic injection of omnopon gr. $\frac{1}{3}$, with scopolamin gr. 1/150 an hour before operation. In addition paraldehyde, two drams by mouth, has been necessary to tranquillize an occasional unruly patient: the scalp can be shaved under the anæsthetic in this type of case.

The fauces, larynx and nares are sprayed with 2 per cent amethocaine hydrochloride or other suitable analgesic, and if the patient will allow it, similar applications are made to the pyriform fossæ. The arm is abducted and firmly supported on a side table or splint. Pentothal sodium 0.3 to 0.6 grm. in 5 per cent solution is injected into a suitable vein, and the syringe secured to the arm by a length of rubber tubing and an artery forceps. Similarly, the wrist is secured to the arm table. A Magill intratracheal tube, lubricated with Brennan's 10 per cent nupercain paste, is passed into the trachea, under direct vision, from the nose. A difficulty sometimes met with occurs when the tip of the tube impinges on the anterior commissure of the larynx instead of slipping between the cords. This can

be overcome by the use of the Magill laryngeal forceps, by altering the degree of flexion of the atlanto-occipital joint, or by using a tube of different curvature. Occasionally oral intubation is necessary, but is less satisfactory in maintenance as kinking and slipping may occur. The glottis in spasm will yield to patience.

With the tube in place, a Rowbotham's angle piece connects it to the hose of a gas machine, led away over the patient's chest. Gauze moistened with saline or paraffin is gently packed round the tube in the pharynx to prevent the patient from breathing air. Gas and oxygen are delivered, with not less than 25 per cent oxygen. The patient must be kept pink the whole time and higher percentages of oxygen may be required. Sufficient total gases must be running to prevent accumulation of excessive amounts of carbon dioxide, i.e., not less than 6 litres a minute. In some of the cases we have used a Mushin type of circle carbon dioxide absorption machine with satisfaction.

The operation is usually performed with the head in moderate flexion, and it is important to see that no kinking of the intra-tracheal tube is caused by the assumption of this position.

A three-way tap is next interposed between the syringe and the intravenous needle, and through the side arm of this a drip apparatus delivers saline which maintains a patent needle throughout the operation. By turning the tap more pentothal can be given as required.

Adrenalin novocain or adrenalin saline is usually injected into the scalp by the surgeon at the beginning of the operation to lessen bleeding.

Observations During Anæsthesia

The blood-pressure, which, together with the pulse-rate, should be charted every five minutes, shows an initial drop due to the pentothal, followed by a rise consequent on the injection of adrenalin. As the operation proceeds there is a gradual drop of about 30 mm. of mercury, but this is seldom serious. There is nothing characteristic about the pulse-rate curve.

The critical stage of the operation is the actual division of the brain tissue, and it is a wise precaution to inject 0.1 grm. of pentothal just before it is carried out to ensure that no slight movement or cough will disturb the surgeon. Very occasionally a patient is encountered whose cough reflex cannot be repressed by reasonable amounts of pentothal, say 1.5 grm. given during the first ten minutes. These have been well controlled by small quantities of trilene.

Sweating, salivation, respiration and pupillary reaction are all influenced by the frontal lobes, to some degree, but we have not encountered any special abnormalities of these functions during operation.

The dose of pentothal should be gauged so that the patient regains his reflexes soon after leaving the theatre. The average dose given was 1.1 grm., while the average operating time was 55 minutes. Two deaths occurred, both due to cerebral hæmorrhage.

In this series of 75 cases, venepuncture was impossible in two cases, and trilene was used to supplement the gas and oxygen. In 5 cases the Oxford Vaporiser was used, in the absence of diathermy. With this machine the depth of anæsthesia was very easily controlled and maintained in upper second plane, but post-operative vomiting was more marked than when pentothal was used. Trilene was used in 5 cases to subdue the laryngeal reflex, in preference to crowding pentothal. Some post-operative vomiting occurred in 15 cases. No respiratory abnormalities were seen in the post-operative period.

Summary

Prefrontal leucotomy is briefly described. Anæsthesia must take into account the mental condition of the patient, the possibility of explosion, and the minimisation of cerebral oozing.

Pentothal sodium with intratracheal gas and oxygen was the preferred anæsthetic, and the technique of using this method is described.

The cases were operated on by Mr. G. C. Knight, F.R.C.S., at the request of Dr. R. Ström-Olsen, at Runwell Hospital, Wickford, Essex.

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THE BUILDING STONES OF ANÆSTHESIA

(A prize essay for the American Society of Anesthetists)

BY

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OPPORTUNITY for subjective discussion in the realm of medicine is ordinarily extended to the experienced leaders. The preceptors of the profession are looked to for review and inspiration, while the apprentices are ordinarily confined to facts and their correlation.

The concession granted by the A.S.A. to the anæsthetist-in-the-making is therefore to be grasped with alacrity, since it may be years in coming again, if at all. And if there is disagreement with the assumption that the ideals and motivations of the beginner in anæsthesia have a place in the development of the specialty, then it is well to remember that, to quote Robert Louis Stevenson, "youth is wholly experimental."

Although the history of anæsthesia exerts obvious influence on any formulation of its ideals, the past will not be a major consideration in this writing. This essay will rather attempt to be a preview, a rough blueprint by an idealistic (and perhaps presumptuous) beginner of the promise that lies ahead in anæsthesia.

While the art of anæsthesia is old, the walls of the *science* of anæsthesia are just rising. Thus, to the apprentice anæsthetist, it seems extremely worth while to examine and predicate the "building stones" which are going to provide the substance and strength of the new edifice of anæsthesia now under construction.

Too often and by too many, anæsthesia is considered to be a flimsy outhouse to the temple of surgery. This is not without precedent nor should it be cause for despair. Both surgery and obstetrics had their origins in the same atmosphere of indignity. It is also true that many who hold bona fide union

cards as craftsmen, have built their houses in the past, not on rock, but on the tenuous tent-poles of a gas machine, a few anæsthetic drugs, and some easily acquired techniques. It is slowly becoming apparent to their colleagues—and to some extent, to the public—that though their efforts are sincere and were prompted by necessity or circumscribed by the trend of the times, these incompletely equipped anæsthetists are not good builders, and are as outmoded as the midwife. As surely as social progress brings about new construction, so surely will the inevitable progress of anæsthesia result in the clearance of these frail houses to make fullest use of the good ground they occupy.

These are war times. Meeting the emergencies created by the demands of destruction displaces in importance all other medical considerations, and the question of medical progress rightly becomes secondary to the vigorous maintenance of freedom and democracy. However, even more than men in government and industry, each of us in medicine has a right—more, an obligation—to look to the future of our endeavours. And, while actual construction might necessarily be delayed, anæsthesia, caught by the world upheaval at a critical point in its own development, must pay particular attention to continuing that development in the right direction.

With the present programme of accelerated medical training, medical practice in all specialties will suffer from a curtailment and condensation of both instruction and clinical experience. But it must be remembered that this present dislocated medical generation cannot and must not be branded as inferior. These physicians did not wilfully crop their basic training; rather they sacrificed it temporarily to meet a greater need. Fortunately, when this emergency passes, and the return to the peacetime pursuit of medical training is accomplished, these physicians, most of them young, will be able systematically to set about bringing themselves up to date. However, in anæsthesia particularly, the self-regulated ideals and ethical standards of the specialty should be kept uniformly high, so that these returning physicians will want to continue their studies, will strive to be fully-equipped anæsthetists in the complete, present sense of the word. That there are great social and economic incentives for these physicians cannot be

denied. For so broad is the need, and so small the supply of proper personnel, that there is more than enough *lebensraum* for all who have the will to build together in anæsthesia.

Apprentice anæsthetists who have this will to build cannot limit their vision to to-day's or to-morrow's clinical routines. They must attempt to develop and sustain a broader viewpoint, and be capable of adjusting themselves to the continuous and inevitable progress of all medicine. They must constantly expose themselves to the ever-growing mass of scientific data accumulated by research and systematized by study. They must, early in their training, visualize for themselves the materials which constitute the very essence of their art—the "building stones" with which they must work to create for themselves, and for society, a sound, lofty edifice of anæsthesia. These "building stones" are the basic medical sciences.

Every would-be specialist must have read and re-read Sir William's Osler's words on the subject of these building stones:

> "The dangers of specializing in a narrow field of practice are not for the strong man, but to the weak brother who seeks in a specialty an easier field in specious garrulity and mechanical dexterity to take the place of solid knowledge. Next to the danger from small men is the serious risk of the loss of perspective in prolonged and concentrated effort in a narrow field. Against this there is but one safeguard—the cultivation of the sciences upon which the specialty is based."

To the anæsthetist, the basic sciences are more than broadening. They are the essence of the specialty as it is practised from day to day. But what is more, it is only from the growth and development of the basic medical sciences that anæsthesia itself can grow. The researcher in his laboratory may seem to be working on a remote problem, but if his discoveries move the basic sciences ahead a step, the anæsthetist in the operating room will eventually feel the push. Obviously, the *sooner* the anæsthetist makes use of the resources developed by the creative efforts of others in all fields, the *sooner* he eliminates the "dead space" between pioneering and accomplishment, the better it will be for his patients, his specialty and himself. The true student of anæsthesia will also feel the need for casting about on his own for necessary new knowledge, thus

combining within the specialty, to an appreciable measure, the processes of discovery and utilization.

One of the things that should impress the progress-seeking aims of any anæsthetist is the realization that his specialty is firmly interwoven with much of the laboratory work now being done in the basic sciences. For, when it is considered that it is common practice to anæsthetize experimental animals, no matter how unrelated the problem under consideration, it becomes apparent that each of these experiments is also an excursion into the field of anæsthetic knowledge. True, in the past, many otherwise astute investigators did not give an anæsthesia adequate attention as an experimental variable. But the growing realization that anæsthetic drugs exert wide effects in addition to their specific narcotic action may require the re-evaluation of a considerable amount of past work, and has already stimulated the interest of laboratory investigators in the whole problem of anæsthesia. Many physiologists, pharmacologists and biochemists are realizing that some knowledge of anæsthesia is almost as important to them as the knowledge of their fields is necessary to an anæsthetist.

This interdependence is certain to produce a great reservoir of accurate and extensive information, not only about the anæsthetic drugs and their specific actions, but also about all the broader problems confronting the anæsthetist.

Needless to say, when a diverse and pooled point of view is applied to these problems, new concepts, new materials and new methods are certain to result. The anæsthetist will not lose prestige by being part of this co-operative research. Rather, he will add to his stature and the stature of anæsthesia by participation.

It is a common expression in medicine that there is a distinct dichotomy between a "clinical man" and a "laboratory man". In anæsthesia particularly, this is an erroneous impression. One reason for this is that though clinical anæsthesia is so closely, almost exclusively, dependent upon laboratory findings, actually there can be no disassociated laboratory limited in scope to anæsthesia *per se*. Fundamental studies have come from the laboratory of the biochemist, the pathologist, the pharmacologist, and the physiologist, but it can hardly be expected at this time that many of these devote their

time and their energies exclusively to problems directly related to anæsthesia. It is pleasant to predict that some day there will be many experts in anæsthesia within each field. However, for the present, it falls to the anæsthetist, who is, after all, most familiar with his own problems, to undertake the solution of many of these problems in the laboratory, where he can also correlate and co-ordinate findings in the basic sciences.

Another reason why the line cannot be tightly drawn between the "clinical man" and the "laboratory man" lies in the laboratory-like set-up of the anæsthetist's clinical headquarters, the operating room. True, every ward and clinic is, in a sense, a laboratory. But in the operating amphitheatre, particularly for the anæsthetist, laboratory methods can be applied to a much greater degree. Here patients are subjected to strenuous therapy and can be observed and managed under conditions of great physiologic stress. The variable factors are relatively few and may often be controlled. Potent and rapidly-acting drugs are administered in doses designed to produce the necessary profound effects, and results may be noted in a relatively short period of time. Cases for study are always forthcoming, since more rather than less surgical procedures are in prospect. As to recording previous preparation, immediate and remote results, these too are and should be part of anæsthetic management, both from the clinical and the laboratory point of view.

To the scientifically-minded physician it is thus apparent that anæsthesia offers a perhaps unparalleled opportunity to study the human organism under the "true" laboratory conditions. Here the observations are not only related to anæsthetic problems. Changes in the body's economy due to drugs, operation and pre-existing disease and dysfunction, furnish data directly related to many of the fundamental problems of the basic medical sciences. And, from the patient's, or clinical point of view, the more that is known and observed and managed in that important part of the body beyond the operative field, the better the potential outcome.

Thus it is apparent that the young anæsthetist sees himself as both a clinician and a scientist, treating patients to the best of his ability, as well as becoming acquainted with, and adding to, the "building stones" of anæsthesia.

More and more, the anæsthetist's knowledge of the building stones and his unique clinical talents are also finding gratifying application in the wider care of patients. He is identified with the relief of pain, not only in the operating room but also in the ward and clinics. His knowledge of the structure and function of the nervous system renders him, through the medium of regional anæsthesia, the ideal adjunct in therapy for broken ribs, angina, hiccoughs and a host of other assorted ailments, where the relief of pain and discomfort is indicated. His familiarity with the nature and effects of powerful drugs makes him a valuable consultant in instances of their abuse and misuse. His everyday observation of derangements of respiration and circulation and his technical ability to deal with disturbances in them bring him into the sphere of oxygen therapy, resuscitation and depressed states.

Is this expansion both into scientific investigation and other fields of practice a brand new adventure? Even the newcomer in anæsthesia can perceive that this is not so. For a sound start has already been made in the broad and scientific practice of anæsthesia by an energetic group of trail-blazers both in Great Britain and America, most of them now respected leaders in the specialty.

To return to the architectural aspects of anæsthesia, it is these men, these forward-looking architects with the urge to build, who have laid the foundation for the future halls of anæsthesia. It is they who have given impetus to the many innovations now thrusting themselves out of the main structure. It is they who have seen the need for dovetailing their designs with the demands of the entire medical community. It is they who are tearing down the rusty fence which for so many years has made the anæsthetist the hermit of the operating room.

It is chiefly up to the young anæsthetist to follow in the footsteps of these foresighted men. For it is the young men who, in the vigour of their youth, must eventually take up both the transit and the trowel. It is they who, with the mortar of human effort, must build the eventual cathedral. What its final shape will be, none of us to-day can tell, and few would have the temerity to hazard a prediction. But towards that ultimate goal, all of us can work.

MALARIA AND THE ANÆSTHETIST

BY

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IT is a sad fact that after this war problems are not going to be inconsiderable; and these will not be only political and economic. In the purely medical realm the incidence of tropical diseases will tax the knowledge of those whose acquaintance with them is as yet practically negligible. In this connection it is true that every doctor will have to be something of a malariologist. Both men and women will be returning to Great Britain after working in some of the world's most highly malarious areas, and the relapse rate is bound to be high for several years. Sir Leonard Rogers (1942) points out that "relapses sometimes occur long after the apparent cure; in Benign Tertian these have been seen up to three years, and in Quartan up to four years after infection. In Malign Tertian relapses are rare after one year". This will constitute a problem which will affect the anæsthetist no less than any other branch of the profession; for the Plasmodium is no respecter of persons, be he patient or practitioner.

In a survey of 1,000 operations performed on the Assam-Burma border; 500 being on Indians; 479 on British; 21 on West Africans; the following figures are of interest.

TABLE I

Total No. of operations	Number of Post-operative Relapses of Malaria				
	Indian	British	West African	Total	%
1000	21	27	2	50	5

This is a relatively low figure but, as might be expected, a further analysis shows that as the severity of the operation increases so does the relapse rate. For the purposes of this table major operations are taken to be those lasting over half an hour.

TABLE II

	No.	No. of Relapses	%
Minor operations	699	9	1.3
Major operations	301	41	13.3

Practically in all cases the relapse was noted within the first three days after operation; but it is probable that they immediately followed the operative procedure, as it is a well-known fact that trauma of any sort brings out a latent infection. These post-operative relapses are, however, usually mild, quickly controlled by the exhibition of the usual anti-malarial drugs, and do not unduly prolong the convalescent period. But this is unfortunately not the full picture. If it were so the surgeon and the anæsthetist might treat the problem as purely incidental. The following three cases afford a grave warning to any such complacency and indicate that where the Malign Tertian parasite is concerned grave complications may occur.

CASE 1—27th July, 1944

A West African was evacuated from Burma with a gunshot wound of the left calf-muscles. The wound, sustained ten days before, was almost healed. However, X-ray showed a bullet embedded in the gastrocnemius. His general condition, apart from a slightly enlarged spleen, was excellent.

July 31st. Bullet removed under pentothal sodium anæsthesia. Duration of operation was 10 minutes: dosage of pentothal 0.6 grm.

August 1st. Onset of evening pyrexia of 104. Spleen being slightly enlarged, blood slides were taken; 6 grains quinine was given intravenously and his temperature subsided to 99.

August 2nd. Treatment was continued orally, quinine 10 grains being administered t.d.s. Two blood slides were negative. Evening temperature again rose to 104 and coma supervened. Quinine 6 grains was given intravenously and quinacrine 0.25 grm. intramuscularly four hours later.

August 3rd. Died, still in coma, in the early hours of the morning.

A post-mortem examination revealed: SPLEEN, enlarged X1½ firm consistence, gritty on section. Marked increase of malphighian

bodies. BRAIN AND MENINGES: superficial congestion of the brain. Smears showed *rings and sporulating forms of plasmodium falciparum*. ANATOMICAL DIAGNOSIS: *cerebral malaria*.

CASE 2—13th June, 1943

A British officer was admitted off patrol. He gave a 14 days' history of acute parotitis, right sided. Just before arrival in hospital a brisk hæmorrhage started in the parotid substance. He was immediately taken to the theatre. Thereafter events were as follows:

8 P.M. While on the table he had a rigor which was judged to be of malarial origin, and a blood slide was taken. On later examination of this Malignant Tertian parasites were found in profusion.

8.5 P.M. Under pentothal sodium 0.5 grm, parotid was incised, blood clot evacuated, cavity lightly packed. During this procedure there was a rupture into the pharynx, with the discharge of small quantities of blood and pus.

8.20 P.M. Patient returned to ward with bed in Trendelenberg.

8.45 P.M. A weak cough reflex was established, but this was lost almost immediately and respiration became Cheyne-Stokes in character.

9 P.M. Matters were complicated by a further small hæmorrhage into the pharynx. This continued intermittently with Cheyne-Stokes respiration for five hours. Treatment was frequent pharyngeal mopping together with oxygen therapy.

June 14th—4 A.M. Bleeding had stopped and a weak cough reflex was established, though respirations were still Cheyne-Stokes.

8 A.M. On receipt of the result of the blood slide, quinine was administered—6 grains intravenously. This was continued four-hourly. The patient died twelve hours later.

Post-mortem Examination. Records are not to hand, but confirmed the diagnosis of cerebral malaria, which probably supervened and caused the disappearance of the initial cough reflex at 8.45 P.M. on June 13th.

CASE 3—22nd June, 1944

At eight in the morning a Madras sepoy sustained an abdominal injury under rather curious circumstances. He had complained of a high fever and, on being excused duties by his guard-commander, went to lie down in the guard-room. While there he suddenly shot two of his companions, and then himself, once in the arm and then in the abdomen. He was brought to hospital and on examination, in addition to his wounds, showed T101, P75, R20, B.P. 105/55 and was comatose. He was given ¼ gr. morphia and taken to the theatre.

10.30 A.M. A drip plasma was started. Anæsthetic was induced with pentothal sodium 0.5 grm. and coramine and continued with nitrous oxide, oxygen and minimal ether (naso-endotracheal route).

11 A.M. The abdomen was opened and investigated through a left

paramedian incision; a larger perforation was found in the jejunum, which was sutured. No other viscus was affected, though a few omental vessels were torn. There was only a little blood in the peritoneal cavity.

During these proceedings following observations were made: pulse-rate rose to 115 and remained constant.

12 A.M. The respiration became uncontrollably Cheyne-Stokes in character. Oxygen and carbon dioxide under tension had no effect.

12.15 P.M. Just before the closure of the peritoneum the onset of ether convulsions was observed. Pentothal sodium 0.25 grm. was immediately administered through the tube of the drip feed and the convulsions subsided before they had involved more than the muscles of the head and neck. Rectal temperature was not taken, but there did not appear to be a rise in temperature, probably owing to early cessations of spasms.

12.30 P.M. The operation was concluded and patient was sent back to the ward where intravenous quinine 6 gr. was given. Cheyne-Stokes respiration continued.

2 P.M. A regurgitant vomiting occurred and, as the cough reflex was not established, an endotracheal tube was inserted orally, accepted and retained.

6.30 P.M. A very weak cough reflex was established; endotracheal tube removed and Hewitt's airway re-inserted.

7 P.M. Airway no longer tolerated; but patient still comatose.

7.30 P.M. Patient regained consciousness but was very confused until death, twelve hours later.

During this post-operative period intravenous quinine in 6 gr. doses was given four-hourly. Three blood slides were negative to malarial parasites. It is unfortunate for the completeness of this record that, owing to extreme pressure of work, a post-mortem was not performed.

Analysis of Cases 1, 2 and 3

Case 1 was a proved relapse of Malign Tertian malaria with cerebral involvement. It is instructive to note that apart from the gunshot wound and a slightly enlarged spleen, the man was in good physical condition; the operation was not one associated with appreciable trauma, and lasted only ten minutes. This was the only fatality in the series. (Table I.)

Cases 2 and 3 were different in that they were pre-operative malaria; but both are reported in order to complete the picture.

Case 2 was then a true pre-operative Malign Tertian malaria with cerebral involvement occurring in the immediate post-operative period, and gave rise to a most difficult period (7

hours) of suppression of cough reflex and Cheyne-Stokes respiration. It also had a fatal termination.

Case 3 was obscure but highly suggestive. The combination of the onset of fever and a confusional state, such as shooting two comrades and then himself, is well known to all who have worked in these parts for any length of time, and is almost always indicative of cerebral malaria. Then, bearing in mind that the pathology of cerebral malaria is largely that of impairment of brain circulation caused by occlusion of the capillaries by malarial parasites, a consideration of certain additional facts make it extremely likely :

1. The low initial pulse-rate in a shocked patient with no head injury.

2. An uncontrollable Cheyne-Stokes respiration appearing during the course of anæsthesia.

3. The long suppression of cough reflex ($6\frac{1}{2}$ hours).

4. The confusional state after recovery, lasting until death. All these might have been caused by circulatory impairment of vessels, or by oedema following such impairment.

5. The occurrence of ether convulsions. Though all the conditions conducive to the appearance of such a complication were present, namely, a pyrexial patient undergoing a long operation where ether is used and under climatic conditions of increased humidity, it is possible that here again the pathology of cerebral malaria supplied a potent factor. Penfield and Erickson (1941) state that " complete arrest of the cerebral circulation results almost invariably in a small convulsive seizure . . . This would indicate that when anoxia reaches a critical level it becomes irritating to the central nervous system." Kemp (1944) states " any factor . . . which interferes with the vital processes of cerebral cell respiration may cause a convulsion in a patient under either general or local anæsthesia." This interference might have well been supplied by the tissue anoxia of cerebral malaria.

Here again the danger of long suppressed cough reflex is noted; but also the onset of Cheyne-Stokes respiration during operation and of ether convulsions, both of which materially added to the difficulties of the anæsthetist.

Discussion

The problem would seem to fall into two divisions: that of the ordinary case where time of operation can be selected; and the acute case which demands immediate action.

With regard to the ordinary case, though the post-operative relapse is usually mild, such a relapse might tip the scales against the safe and speedy recovery of the patient, even if not as catastrophic as in Case 1. It is therefore advised that suppressive treatment such as Mepacrine, tablet one, should be given daily in the four days proceeding operation and carried on thereafter until the patient is well through the convalescent period. It might be added that a history of no previous malaria is not sufficient to excuse the patient from such a course. The criterion is rather whether he has passed any period in a malarious area, for Napier (1943) writes "... physical strains such as surgical or obstetrical operations will often bring out latent infection in any individual who has no knowledge of a previous attack. In such cases the parasites are so scanty, and are possibly hiding in the tissue of some internal organ, that a previous blood examination would not reveal their presence, and it is therefore advisable to give a course of Cinchona as a routine measure before the confinement of, or a surgical operation on, anyone coming from a highly malarious area." It may be mentioned here that after this war the list of such areas may be large, namely, North and West Africa, India, Burma, the Far East, including the Pacific Isles, Palestine, the Balkans, Italy, Holland.

The emergency cases may, however, present a very different picture, and one which is fraught with danger during and after operation. In such cases a careful assessment of the situation must be made, and where malaria of the Malign Tertian type, which can give rise to these brain involvements, is proved or even suspected, prompt pre-operative treatment must be instituted. In Case 2 twelve hours were wasted, in Case 3 two and a half hours, and in this latter period a major operative procedure was carried out. It is unfortunately true that in such cases lost time often means a lost patient. In view of the urgency of warding against or treating a cerebral involvement, quinine 6 gr. is usually given intravenously. But in 30

to 40 per cent of cases investigated in this hospital a fall of some 10 mm. of mercury blood pressure has been observed. Here lies a difficulty, for this might well make a poor operation risk hopeless. In such cases the intramuscular injection of Mepacrine Methane-Sulphate (Quinacrine) is advised as both efficacious and safe, if administered in doses of 0.15 to 0.25 grm.

Summary

1. In Great Britain post-operative relapses of malaria will not be infrequent after the war.

2. These relapses are usually mild in character.

3. Suppressive treatment is, however, advised both in the pre- and post-operative period.

4. There are, however, graver complications.

5. In any case of true or suspected M.T. malaria quick pre-operative action must be taken.

6. The danger of quinine, administered intravenously, is stressed in serious operation risks.

7. The intramuscular injection of Mepacrine Methane-Sulphate (Quinacrine) is the method of choice.

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A NEW SPHYGMOSCOPE

BY

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AND

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THE minute-to-minute observations of systolic pressure, diastolic pressure, and heart-rate is generally acknowledged to be of great value in estimating the condition of patients undergoing severe surgery, or during resuscitation. It is particularly in regard to the latter that this need has become manifest under the conditions obtaining during this war. Although many types of blood-pressure indicator have been described, there appears to be a need for an instrument specifically designed for use in the operating theatre. The requirements for such an instrument are as follows:

(i) A clear indication of systolic and diastolic pressures.
(ii) A visual, in preference to an auditory, method of observation.
(iii) Robustness of design and construction.
(iv) Reliability in operation and simplicity of handling.

In addition, a *continuous* indication of heart-rate and pulse-pressure would greatly enhance the value of such an instrument.

* Working with a personal grant from the Medical Research Council.

During the past three-and-a-half years we have been engaged in developing such an instrument, and an earlier model of it was demonstrated to the Royal Society of Medicine (Section of Anæsthetics) a year ago (Evans and Mendelssohn; Mallinson, 1943).

Method

The method on which the instrument is based is shown diagrammatically in Fig. 1. Two cuffs are employed, and are placed on the leg (or the arm can be used instead), the proximal

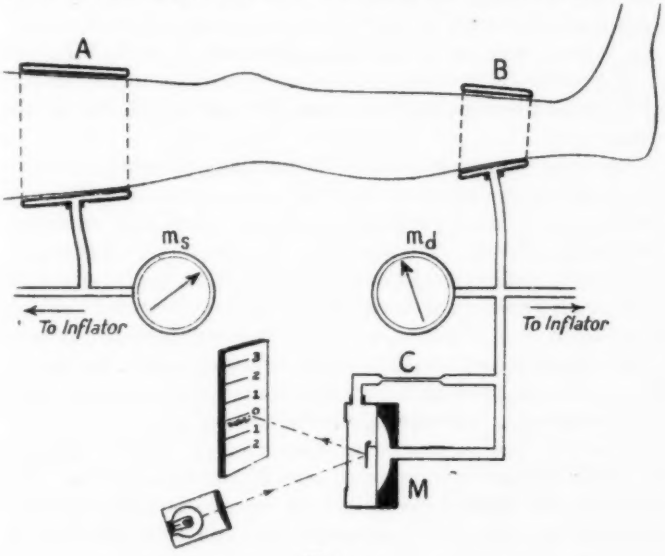

Fig. 1

one, *A*, above the knee, the distal one, *B*, above the ankle joint. The cuffs can be inflated independently, and the pressures in them recorded on two separate aneroid manometers, m_s and m_d.

A very sensitive differential membrane manometer, *M*, which indicates arterial pulsations by means of a light beam and scale, is attached to *B*. The two chambers of this manometer are connected by a capillary, *C*, which ensures that both are at the same mean pressure, but that only the chamber directly connected to *B* receives pulsations from the cuff.

Systolic pressure is determined as that pressure read on m_s for which pulsations in *B* disappear. Diastolic pressure is determined as that pressure read on m_d (cuff *A* being deflated) at which the pulsations undergo a sudden decrease in amplitude as the cuff pressure is lowered.

While we are not aware that this method, or rather combination of methods, has been previously employed, there are, among the numerous devices described in the literature, several which possess certain features in common with ours. It is, however, necessary to point out that the particular arrangement chosen was not arrived at by the usual method of clinical experimentation, but was developed by two of us (D.S.E. and K.M.), on the basis of an analysis of the physical factors underlying blood-pressure determination. (Evans and Mendelssohn, 1942.)

The most important feature of this physical analysis is the result that, at the moment when the mean pressure in *B* during release passes diastolic pressure in the artery, the observed pulsations decrease. The treatment also shows that one cannot expect any easily recognisable change in the pulsations in *B* at systolic pressure. Hence our use of the proximal cuff, *A*, in addition to *B*. Finally, it can be shown that if the pressure in *B* is kept at any constant value below diastolic, the size of the pulsations gives an indication of the pulse pressure, while their frequency, of course, gives the heart-rate.

The mathematical treatment of such a very complex problem naturally requires a number of simplifying assumptions. For instance, we treated the artery as an elastic tube, obeying Hooke's law to a first approximation, and the tissues as an incompressible jelly. The experimental results show, however, that these simplifications are fully justified. Fig. 2 [see art plates] shows (a) our theoretical curve of the pulsation size against the mean pressure in *B*; (b) a direct photographic record of these changes in pulsation size with falling pressure as observed with our instrument.

As can be seen, at diastolic pressure, the size of the pulsation suffers a reduction to just over half its value within a pressure interval of about 5 mm. In auscultatory comparison tests this decrease has been found to be well within the interval defined by the usual auditory criteria for diastolic pressure.

The range of 5 mm. is approximately the natural uncertainty with which diastolic pressure can be determined at all, owing to its natural variation with respiration. It can also be seen that, as predicated by the theory, there is no significant change in the pulsations in a single cuff to be observed at systolic pressure. Fig. 2 (c) shows the sharp definition of systolic pressure (also compared and found to agree with the values obtained by auscultation) observed on our instrument when both cuffs are employed. The record is of pulsations in *B* (set at constant pressure) while the pressure in *A* is allowed to fall gradually. Of a great number of recorded cases all show these salient features; in a small percentage, particularly in children, the reduction at diastolic is less than one-third. However, even in these cases, a sharp definition is easy after a little experience. The detection of diastolic pressure is further facilitated by the fact that at this point there is a striking upward shift of the zero, together with a marked change in the character of the pulsation. Above diastolic, the opening and closing of the artery during each cycle produces a sharp jerky pulsation, whereas below diastolic the unhindered oscillations of the artery produce a smooth regular pulsation. The dicrotic wave also appears below diastolic.

Records have also been taken of the change of pulsation with change of pulse pressure. These and other records, together with a discussion of the observed effects, will be reproduced elsewhere.

It is only natural that the solution of a clinical problem by the methods of the physicist should have given rise to doubts as to their applicability. The points raised have been dealt with in a printed discussion (Evans and Mendelssohn *et al.*, 1943) of our theoretical paper, but perhaps the best justification is provided by the photographic records reproduced here.

Description of the Sphygmoscope

In the actual construction of the instrument particular care had to be taken to protect the sensitive membrane from damage by excessive differences of pressure. The differential manometer has frequently to be inflated to pressures ranging up to 300 mm. of mercury, while its own sensitivity range to pressure differences between its two chambers is less than 1 mm. of

mercury. The tap *D*, which permits inflation and deflation of the circuit (Fig. 3), is operated by the same cam-shaft as tap *D*, which opens and shuts a wide by-pass connecting the two chambers of the differential manometer *M*. The operation of the taps is so arranged that it is impossible to inflate or deflate

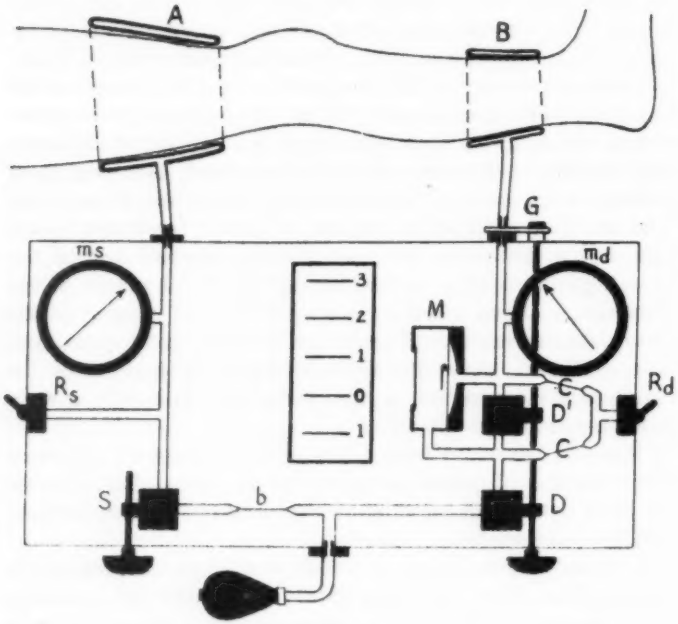

FIG. 3

the circuit without first opening the by-pass. A short capillary, *b*, separates the taps controlling the flow of air to cuff *B*, from tap *S*, which controls the flow to cuff *A*. This capillary serves to prevent a sudden flow of air from cuff *A* into the manometer *M*, which might otherwise occur during inadvertent erratic manipulation of the taps. The only remaining source of danger to the manometer is that the cuff *B* might be detached from the instrument while it was inflated, and this is prevented by the provision of a gate, *G*, controlled by the shaft operating

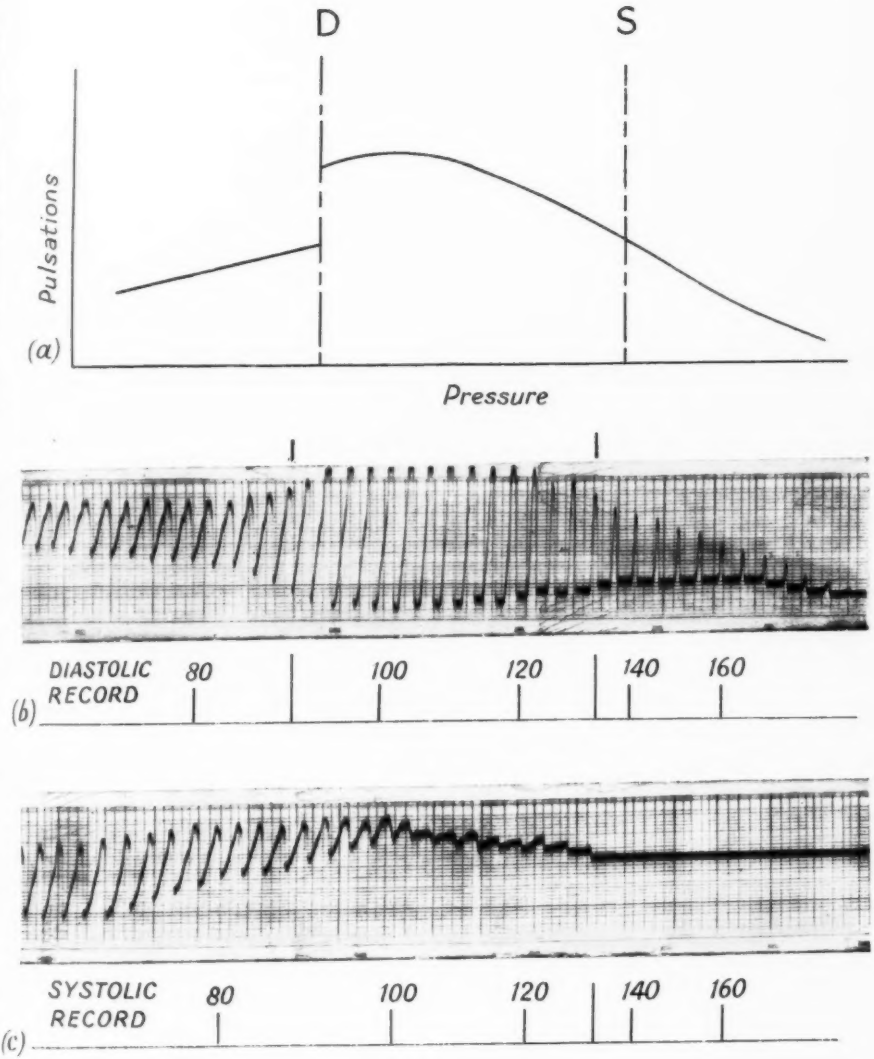
D
S
Pulsations
(a)
Pressure
DIASTOLIC RECORD
80
100
120
140
160
(b)
SYSTOLIC RECORD
80
100
120
140
160
(c)

FIG. 2

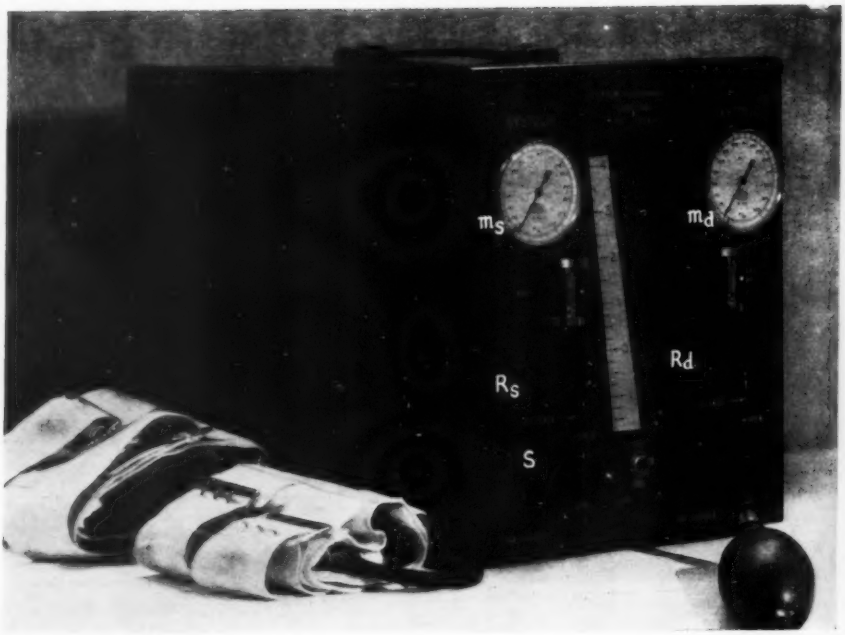

FIG. 4

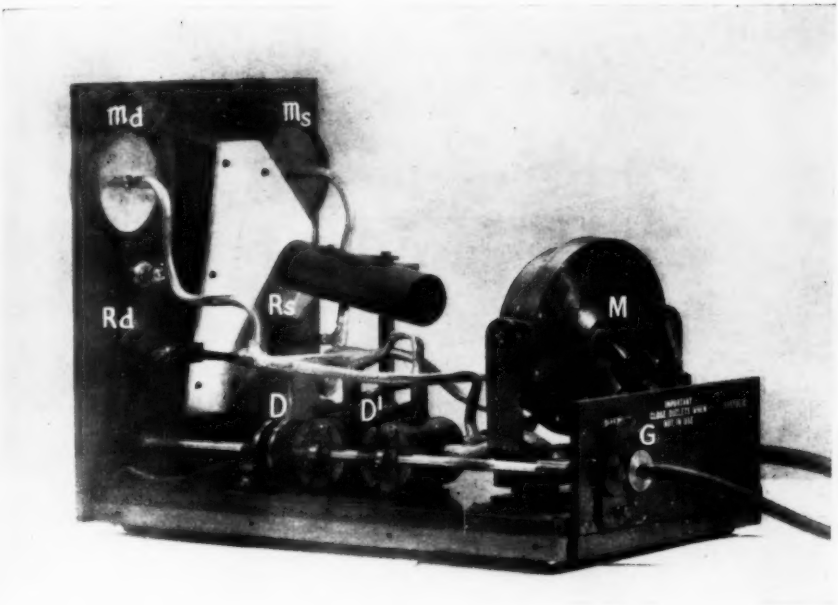

Fig. 5

taps *D* and *D'*, and holding the connecting tube in place when the by-pass is closed.

R_s and R_d are two release valves which allow a gradual deflation of the two circuits. Their operation is similar to that of an electric light switch, and their release speeds are controlled by standard capillaries, and are not under the control of the operator. R_d is tapped off from the capillary *C* at such a point that the air-flow from the two sides of the differential manometer is equal, thus preventing any large shift of the zero position of the light spot on the scale during release.

Figures 4 and 5 show two photographs of the apparatus. All the controls are arranged on the front panel, those controlling the proximal or "systolic" cuff being on the left; those for the distal or "diastolic" cuff on the right. The light beam falls on the upright illuminated scale in the centre. The case contains a dry battery for the lamps, and a compartment for carrying the cuffs and inflator. The lamp is inserted into position on the left of the front panel by a simple quarter turn of its holder, and can readily be exchanged with the spare carried on the right side of the panel.

Mode of Operation

After the cuffs have been attached to the patient the connecting tubes are fitted to the rear end of the sphygmoscope. With tap *D* (and therefore also *D'*) open, and tap *S* closed, cuff *B* is inflated to a pressure appreciably higher than the expected diastolic. Tap *D* is then closed and pulsations of the light spot are seen on the central scale. The release valve R_d is then opened and the size of the pulsations on the scale is observed. When these undergo a sudden decrease, R_d is closed, and the pressure (which is the diastolic pressure) is read on m_d.

The tap *S* is then opened and cuff *A* inflated to a pressure higher than the expected systolic. When tap *S* is closed no pulsations of the light spot are seen. Release valve R_s is then opened, and is closed again at the moment when pulsations are observed to commence. The pressure (which is the systolic pressure) is then read on m_s. Tap *S* is then opened and cuff *A* deflated.

For the continuous estimation of pulse pressure and heart

rate, cuff *B* is deflated to any convenient constant pressure well below diastolic, and the size of pulsations is noted. The excursions of the light spot on the scale are proportional to the pulse pressure which has just been determined from the independent measures of systolic and diastolic pressures. Changes in pulse pressure during the operation are indicated by corresponding changes in the size of the pulsation. Cuff *A* is not needed for this observation and is left deflated throughout. This constant pressure in cuff *B* can be marked by the adjustable scale-mark provided on m_d so that the selected pressure can readily be re-set if intermittent application is desired.

Clinical Observations

The instrument has been used by one of us (F.B.M.) on upwards of 100 cases in the operating theatre. The visual method has long been felt to be superior to auditory methods owing to the equivocal results so often obtained in diastolic measurement with the latter. This superiority is further stressed in those cases where an auditory method would have necessitated strapping a stethoscope in an inaccessible position over an artery. The possibility afforded of using the leg as an alternative to the arm was a considerable advantage; such a procedure would have been impracticable with an auditory method because of the lack of a suitable vessel for auscultation.

However, it must be remembered that the readings for systolic pressure (and therefore of pulse-pressure also) obtained from the leg during operation or resuscitation are higher than those which would be obtained from the arm under the same circumstances. Unfortunately it is not possible to deduce "arm" and "leg" values from one another because the difference between the two varies from patient to patient. This means that well-established criteria of fitness for operation or of the need for the institution of anti-shock measures which have been based on arm readings cannot be transferred to readings made on the leg. It is open to the user of this instrument either to devise new criteria, or to work as here before.

It was found that the present instrument gives a definition of the systolic point at least as good as that given by auditory methods under the best conditions of hearing, and the diastolic

point is more easily and accurately estimated than with other instruments known to us. It has been found of considerable help to the anæsthetist, particularly in touch-and-go periods, to have an estimate of the pulse-pressure and heart-rate of the patient from a mere glance at the pulsations continuously recorded on the screen. No ill effects have been observed from leaving the cuff inflated to a small pressure throughout the operation.

In addition, on several occasions the instrument has proved of value to the physician in cases of arterio-venous aneurysm and other circulatory troubles where auditory estimation would have been impossible.

The Sphygmograph

In view of the possibility that the instrument might prove to be of value for diagnosis or for physiological investigation, a model has been developed embodying a photographic recording device. This will enable records to be studied at leisure, and perhaps more subtle features than those indicated by our simple theory may be revealed. The photographic records reproduced in Fig. 2 have been obtained with this instrument.

Acknowledgements

We are indebted to Mr. H. J. Pye, Director, and Mr. E. Root, Technical Supervisor of Clifton Instruments Ltd., Cambridge, for many helpful suggestions and for the unfailing patience and breadth of technical experience by which the instrument was brought to a form suitable for commercial production.

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Evans and Mendelssohn; Mallinson. *Proc. Roy. Soc. Med.* (Section of Anæsthetics), 1943, xxxvi, 465.

Evans and Mendelssohn, *et al.* Discussion on Evans and Mendelssohn, 1942. *Proc. Phys. Soc.*, 1943, lv, 410. (This discussion includes a list of references to other blood-pressure indicating devices.)

VINYL PORTEX ENDOTRACHEAL TUBES

BY

A. R. HUNTER, D.A.

THE difficulties of using rubber endotracheal tubes have long been appreciated by all anæsthetists, but for many years there has been no other material satisfactory for this purpose. Recently Messrs. Portland Plastics Limited, whose products are well known to the dental profession, have placed on the market a vinyl acrylic resin plastic which can be made into excellent endotracheal tubes, which possess several advantages over the rubber tubes in general use to-day. These have been summarized by Major H. L. Thornton in the *British Medical Journal* (1944, ii, 14). Briefly they are these:

1. The tube softens on boiling but resumes its original rigidity when cooled. It can thus be moulded to any desired curve without difficulty. Repeated boiling is without effect. The other day I heard of a tube which had been boiled some two hundred times and was still serviceable.

2. The tubes are unaffected by ether, chloroform, and the other anæsthetic agents in common use. It is feasible to clean adhesive from Vinyl Portex Tubes with ether without damaging them, which is more than can be said for most rubber tubes.

3. Vinyl Portex Tubes show very little tendency to kink and are made with a rigidity which is rather greater than that of rubber tubes of the same thickness, though they are equally flexible. This property makes them especially valuable as endotracheal tubes for young children. It is well known that rubber tubes of this size are either sufficiently rigid and too narrow, or of reasonable diameter and too soft.

4. Vinyl Portex Tubes are unaffected by oily lubricants.

It has been my privilege to use some Vinyl Portex Tubes supplied to me by Messrs. Portland Plastics Limited, for

almost all the endotracheal anæsthetics required at a busy neuro-surgical centre during the past three months. The original tubes are still in use and are as good to-day as when they were first obtained. They have proved especially valuable for operations for cerebellar tumour in young children, and for the repair of spina bifida.

They are more satisfactory than the new black synthetic rubber tubing.

ASSOCIATION OF ANÆSTHETISTS OF GREAT BRITAIN AND IRELAND

THE Annual General Meeting for 1944 was held at the Royal College of Surgeons on October 25th. The revised form of the Constitution was approved and the following Officers were elected :

President: A. D. Marston (London).
Vice-President: C. Langton Hewer (London).
Hon. Treasurer: Z. Mennell (London).
Hon. Secretary: W. A. Low (London).

Members of Council:

J. H. T. Challis (London).
Ashley Daly (London).
S. F. Durrans (Bournemouth).
Frankis Evans (London).
B. L. S. Murtagh (Birmingham).
Freda Bannister (Oxford).
John Gillies (Edinburgh).
R. Blair Gould (London).
Ronald Jarman (London).
A. W. Matthew (London).
F. F. Waddy (Northampton).
H. Woodfield-Davies (London).

Trustees of the Association were nominated : Ashley Daly, H. W. Featherstone and Z. Mennell.

The retiring President, Brigadier Ashley Daly, read his Annual Report including an account of the activities of the Council. We append a short summary. The Council met on six occasions, attendances being most satisfactory, and including those of Dr. Minnitt from Liverpool and Dr. John Gillies from Edinburgh. The Association now numbers 131 Fellows and 113 Members, of whom 71 have been elected since the last Annual Meeting. The chief event of the year has been the acquisition at last of a permanent home for the Association. The move to the Royal College of Surgeons has been an unqualified success. We have an excellent office for our

Secretariat, a delightful room for our Council meetings, and the privilege of meeting to-day in this historic building. In future the work of the Hon. Secretary will be much lighter, and we must pay tribute to the enormous amount of time and labour that Dr. Marston has put into the affairs of the Association during the last three years. The Royal College of Surgeons has paid us the compliment of inviting one of our Fellows to sit on their Council, and Dr. A. D. Marston has been elected for this office. The Council of the Association expressed its approval of the policy of having an official journal, as soon as practicable.

A gift of £150 has been received from Mr. Leslie Gamage to enable the Association to purchase letters patent for a grant of arms and supporters. The motto "*In Somno Securitas*" has been adopted at Mr. H. S. Souttar's suggestion.

ABSTRACTS.

"Refrigeration Anæsthesia." V. RICHARDS in *Annals of Surgery*, Vol. 119, No. 2, p. 178.

The author concludes that, from an analysis of the available clinical and experimental material, many of the advocated advantages of refrigeration in infection, shock, traumatic injuries, vascular occlusions and reconstructive extremity surgery seem untenable. It was hoped that refrigeration might preserve the vitality of many limbs suffering from these affections. Bacterial growth is retarded by refrigeration but so also is the tissue response to inflammation, and on release of the cooling the inflammatory reaction may be aggravated. In an injured extremity with intact blood supply the application of a tourniquet is hazardous for it increases the subsequent shock by adding to trauma the effects of tissue asphyxia. Cooling alone of such a limb is of doubtful value. If a tourniquet must be applied to the injured extremity, then refrigeration of the anoxic parts distal to the tourniquet lessens the subsequent shock on release of the tourniquet. It is true that refrigeration anæsthesia has decided advantages in the control of shock, hæmorrhage and infection if sacrifice of the limb has been decided upon. This has been particularly shown in elderly debilitated patients toxic from gangrene or infection in a limb. A tourniquet combined with refrigeration eliminates in such people the absorption of toxins, promotes bacteriostasis, avoids gross necrotic changes in the limb and permits its removal in a bloodless and anæsthetic field.

"A New Vasoconstrictor." F. W. MARVIN in *Current Researches in Anæsthesia*, Vol. 23, No. 2, p. 45.

Popadrine hydrochloride, which is phenyl-propanol-amine hydrochloride, has been used on over 750 surgical patients. This clinical trial confirmed the advantages found in laboratory

tests. The safety of the drug has been proved and its success in raising blood-pressure. It maintains the desired level for a longer period than do other vasoconstrictors. It was used subcutaneously, the dosage is not mentioned, but the drug is sold in ampoules, on which presumably this omission is rectified. It states, however in the article, that the maximum tolerated dose of propadrine hydrochloride is two to three times that of ephedrine.

"*High Dilution Pentothal for Sedation, Narcosis and Anæsthesia.*" H. LENOWITZ AND OTHERS *in Current Researches in Anæsthesia*, Vol. 23, No. 2, p. 78.

The authors have given a solution of 1 in 1,000 pentothal by continuous intravenous drip. They have used it for apprehensive patients during spinal and local analgesia and for the prolongation and support of these. The patient often sleeps throughout the operation. It has also proved efficacious to relieve vomiting when this starts during spinal analgesia. The authors believe that local analgesia combined with 1 in 1000 pentothal is ideal for patients who are poor surgical risks. This weak pentothal solution produces no post-operative complications. It is not desirable to use a solution of pentothal which is more than 12 hours old.

"*Narco-analysis with Nitrous Oxide.*" C. H. ROGERSON in *British Medical Journal*, June 17th, 1944, p. 813.

Usually the barbiturates have been used by the psychiatrist when he wished to employ narco-analysis. It is obviously a great advantage if equally good results can be obtained with the far less risky agent—nitrous oxide. The author finds that the Minnitt apparatus, with its 45 per cent nitrous oxide to air delivery gave him much satisfaction. Occasionally the mixture was too weak for a patient and then it was strengthened by closing some of the air-inlet holes. The patient is not rendered unconscious when the approach of this is heralded by restless movements or change in the rhythm of respiration, the inhalation is stopped.

"*The Orthopædic Anæsthetist.*" H. G. B. LUCAS AND I. A. G. DICK in *Lancet*, August 19th, 1944, p. 243.

The authors maintain that co-operation between surgeon and anæsthetist is essential for good results from orthopædic surgery and that the anæsthetist has duties to perform besides giving the anæsthetic. He must apply the tourniquet and during operation must supervise "in touch" technique while the surgeon is entirely occupied with his own activity. For certain closed manipulations, such as reduction of a fractured spine, local anæsthesia is unsatisactory and general anæsthesia difficult for the anæsthetist, while not making for good operating conditions for the surgeon. The principle employed instead is to reduce the patient to a state of "intoxicated co-operation" by the aid of Phenobarbitone and Omnopon. This is started 24 hours before the manipulation, with Phenobarbitone gr. 1–3 repeated every four hours. An hour and a half before operation Omnopon gr. 1/3 and Scopolamine gr. 1/150 are given subcutaneously. Fifteen minutes before manipulation firm pressure is applied over the site of fracture. If this evokes more than discomfort, more Omnopon is given intravenously. This technique of intravenous Omnopon is also used for changing plasters.

"*Epidural Anæsthesia.*" R. L. ALMOND in *South Africa Medical Journal*, May 27th, 1944, p. 176.

The author briefly describes the anatomy of the epidural space, points out that some 20 c.c. of fluid are required before penetration through the intervertebral foramina occurs, and it is then that the nerve is anæsthetized, having lost its dural sheath. The first effect of the introduction of fluid is to distend the whole space and only when pressure in the space has reached a certain level does the fluid strip the loose attachment to the intervertebral foramina and reach the nerve. Fluid being introduced posteriorly, the maximum effect is felt by the posterior sensory component of the nerve, while voluntary muscular contraction is still possible. The author has used the method for every type of abdominal operation, many of the patients being very poor risks, in whom death on the table would, he

believes, have attended any other method of anæsthesia. Pre-operatively he gives Omnopon, gr. 1/3, one and a half hours before operation and again half an hour before. The technique of injection, during which a manometer is used, is described in detail. For supplementary anæsthesia, often needed in upper abdominal surgery, he relies on pentothal.

REVIEWS

"*Inhalational Therapy.*" By ALVAN L. BARACH, M.D. pp. xvi + 305. 59 Illustrations. Price 4.00 dollars. Lippincott, Philadelphia.

This excellent monograph fills a need of which anæsthetists have been conscious for some time; and it is indeed fortunate that the work has been achieved by one who has so just a claim to speak with authority, since he has contributed so much to our knowledge of the subject.

After an introductory chapter each condition which is susceptible of treatment by the inhalation of gases or vapours is discussed in a separate section. In each case the condition is defined, its pathological physiology is described and the appropriate inhalational therapy is discussed. At the close of this section a chapter is devoted to a discussion of the points which call for further investigation in the future; and this chapter closes with a dissertation on specialism which is both wise and sound, and which is as applicable to the anæsthetist as to the physician interested in inhalational therapy. The last seventy-seven pages are occupied by a description of the apparatus and methods in common use for the administration of gases or vapours.

The discriminating reader may find cause to regret that the phraseology employed is not of the same standard of excellence as the matter of which it treats. Adjectival nouns abound in the text: the wrong preposition is often used; and on several occasions the word "surgery" is used to describe an operation, and the word "pathology" is used where "a lesion" is intended. On pp. 174–5, the terms "upper lung" and "lower

lung" are repeatedly used, and one presumes that what the author means is "upper lobe" and "lower lobe".

Anæsthetists will not agree with the statement on p. 152 that "a mixture of 14 per cent of oxygen and 86 per cent of nitrous oxide will not provide anæsthesia to pain in the absence of other anæsthetic drugs"; for nitrous oxide is known to produce analgesia at far lower concentrations. The other remarks on anæsthesia are sound, and the author stresses respiratory depression and insufficient oxygen in the mixture respired as the important causes of hypoxia during anæsthesia. Although he mentions obstruction of the airway he does not appear to realize that this cause of hypoxia is at least as important as the two he stresses. The chapters on asphyxia neonatorum and obstructive lesions of the respiratory passages are excellent. Anæsthetists would welcome a more detailed discussion of post-operative atelectasis. At every mention of carbon dioxide the author steers a fair course between extreme enthusiasm and excessive caution.

Since as yet but few hospitals enjoy the services of an expert who devotes his energies exclusively to inhalational therapy, the supervision of this work often falls to the lot of the anæsthetist. To him there is no more valuable experience than a study of the various conditions in which a patient suffers from a lack of oxygen; for such an activity forces him to "think in physiological terms". Dr. Barach's book will prove a powerful stimulus to this end. It should be read by every anæsthetist, and many will find a copy indispensable for purposes of reference.

"*Regional Analgesia.*" H. W. L. Molesworth, F.R.C.S. pp. 90, demy octavo, illustrated. Price 8/6 net. H. K. Lewis and Co., London.

This is an admirable little book by a surgeon, which will greatly help any anæsthetist who wishes to become expert in regional methods. The author takes a judicial and broad-minded view of the choice of anæsthetic methods, and gives the indications which lead him to choose regional when he can. With these indications most anæsthetists will, we believe, be in agreement, as they will with the conditions he enumerates

in which regional analgesia should not be employed. After the discussion of general principles W. Molesworth goes in detail into an account of the various methods of regional analgesia and then proceeds in subsequent chapters to describe the application of these to the extremities, the head and neck, and the abdomen. A short chapter on spinal analgesia concludes the book, which we can strongly recommend as a concise, clear, and reliable exposition of its subject.

"*Practical Anæsthetics.*" J. Ross MacKenzie. pp.viii + 136. 63 illustrations. Price 10/6. Ballière, Tindall and Cox, London.

This book is not intended for specialists. In spite of the growing number of expert anæsthetists, there are still inevitably many occasions on which an anæsthetic must be given by a man who has but limited experience in its administration. For such men this book is an admirable guide and should be of great service to the house officer who has often to give anæsthetics before he has had much experience of them. We note that when discussing basal narcotics the author starts with "age of patient, 12 to 16 years," but we do not imagine that he means to imply that basal narcosis is not and cannot be often used with advantage for patients much younger than this. Again, when talking of the pupillary reflex, he does not point out how the value of this is entirely destroyed by premedication with any form of opiate. One other cavil we have at him and that is that he tells the anæsthetist to use certain percentages of ether. But in all open methods there is no means of knowing what the percentage inhaled is, and the author does not give the student any information on the point. We have picked on these little defects because we find no others. The author has covered the whole field admirably, as might be expected by one of his wide practical experience and extensive study of the literature of his subject. There is an excellent bibliography to each chapter at the end of the book, to equip the candidate for the D.A. Details of the regulations for the Diploma are also provided, and there is a short chapter on oxygen therapy. In spite of the number of anæsthetic text books we believe that the production of this one will serve a useful purpose and is to be highly commended.

"*Recent Advances in Anæsthesia and Analgesia.*" C. LANGTON HEWER, M.B., D.A. Fifth edition. pp. 343, illustrated. Price 18/-. J. & A. Churchill, London.

The latest edition of Dr. Langton Hewer's well-known and deservedly successful book keeps up the high standard of its predecessors. Its author's industry and thoroughness have ensured that nothing of importance that has been introduced into anæsthetic practice since the last edition has been omitted. He has added a chapter on anæsthetic charts and records, a subject that has of late received much more attention than formerly. New matter also comes in where trichlorethylene is dealt with, and in the discussion of intravenous general analgesia with procaine, of pethidine analgesia in obstetrics, and of fractional caudal block. We are sure that the student of anæsthetics need go no further than this book for sound information on all the most recent developments of the science and art of his subject.

"*Textbook of Anæsthetics.*" R. J. MINNITT, M.D., D.A., and JOHN GILLIES, M.C., M.B., D.A. Sixth edition. pp. 487. Many illustrations. Price 25/-. E. and S. Livingstone, Edinburgh.

It is four years since the last edition of this book, which, originally Ross and Fairlie's "Handbook", has now grown to be a complete and first-rate textbook for practitioner and student. New chapters have been added on trichlorethylene, endotracheal and intravenous anæsthesia, and on anæsthetics for dentistry. Major L. A. Wevill contributes a detailed account of local and regional anæsthesia. There is a capital chapter on anoxæmia and other changes in the blood gases, and one of the great merits of the book as a whole is that the physiological point of view as regards the patient and his treatment is never lost. Nevertheless all the teaching is directly practical, and the work is so well and clearly written that the student should have no difficulty in using it as his "*vade mecum*" when he does his anæsthetic clerking, while at the same time there is much in the book to help the practitioner and the specialist when they find themselves confronted with some problem of anæsthesia. The manner of the book is equal to its matter, and we congratulate all concerned.

CORRESPONDENCE

To the Editor, *British Journal of Anæsthesia.*

DEAR SIR—In March last, Humphrey and McClelland[1] reported thirteen cases of paralysis of cranial nerves after anæsthesia. Carden[2] also reported two such cases. Not all these patients were anæsthetized with trichlorethylene, but this drug had previously been in use in the machines subsequently used on the patients who developed this complication. These authors adduce evidence which suggests that, in the presence of soda-lime, especially if the latter be at a high temperature (70° C.) trichlorethylene decomposes into dichloracetylene. The latter substance is highly toxic to animals, and can explode spontaneously with great violence. The authors already quoted, as well as Hunter[3] and Hewer[4] have all drawn from these facts the conclusion that trichlorethylene should not be used by the absorption technique.

The German chemist Ott[5] was the first to investigate carefully the properties of dichloracetylene. He found that the reaction between trichlorethylene and a mixture of potassium hydroxide and lime (at 130° C.) yielded 65 per cent of dichloracetylene; but that this reaction could be "inhibited" if 10 per cent of silica were added to the alkali. This statement in the context of a chemical paper might mean merely that the yield was greatly reduced: but that dichloracetylene was still found in quantities sufficient to be clinically dangerous.

The various brands of soda-lime differ in composition, and their influence on the decomposition of trichlorethylene has also been found to vary.[1]

The possibility that the decomposition of trichlorethylene into dichloracetylene can be inhibited by the addition of silica to the soda-lime merits careful investigation. For, if a mixture of silica and soda-lime can be prepared which is both effective

as an absorbent of carbon dioxide, and as an inhibitor of decomposition, there is no reason why trichlorethylene should not be used by the absorption technique.

We are, Sir, yours faithfully,

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2. Carden, S. *Ibid.*, p. 319.
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